be used to refer to $PM_{2.5}$. $PM_{2.5}$ is an indicator of the fine mode particle mass but it is not an exact indicator, since $PM_{2.5}$ may contain some coarse mode PM. Likewise, PMCoarse or coarse refers to the inhalable fraction of the coarse mode, not the entire coarse mode. Under high relative humidity conditions PMCoarse may contain some fine mode PM.

The nonurban coarse aerosol mass concentration in the size range 2.5 to 10 μm is given in the seasonal maps in Figure 6-9. It is plotted on the same concentration scale as the nonurban $PM_{2.5}$ and PMCoarse maps to show that the nonurban coarse mass concentration is less than the fine mass concentration over most of the country. The lowest nonurban coarse particle concentration is recorded during the first, second, and fourth calendar quarters when virtually the entire conterminous United States showed values <10 $\mu g/m^3$. The industrialized Midwest, adjacent to the Ohio River, shows low PMCoarse concentration (<10 $\mu g/m^3$) comparable to the relatively clean Rocky Mountains states. The highest nonurban coarse mass concentrations appear during quarters 2 and 3. In quarter 2, the southwestern United States adjacent to the Mexican border shows the highest nonurban coarse mass concentrations. In quarter 3, the monitoring sites in Florida and Southern California exhibit high concentrations (>12 $\mu g/m^3$).

6.3.1.3 Nonurban PM_{10} Mass Concentrations

Maps of seasonal average nonurban PM_{10} concentrations are shown in Figure 6-10. PM_{10} is the sum of the $PM_{2.5}$ and PMCoarse. The spatial pattern from east to west, including the delineation of aerosol regions, is generally similar to the $PM_{2.5}$. However, the PM_{10} concentrations exceed the $PM_{2.5}$ by up to a factor of two depending on region and season. The sparseness of nonurban sites over large areas of the central United States limits the reliability of profiles in these areas.

In the eastern U.S., PM_{10} concentrations range between 12 $\mu g/m^3$ in Quarter 1 and 25 $\mu g/m^3$ in Quarter 3. During the transition seasons (Quarters 2 and 4) the eastern U.S. non-urban PM_{10} concentrations are about 15 $\mu g/m^3$, except in New England. The lowest PM_{10} concentrations are measured over the central mountainous states, 5 $\mu g/m^3$ in Quarter 1, 10 $\mu g/m^3$ in Quarter 3, and 7 $\mu g/m^3$ during the transition seasons. Higher PM_{10} concentrations, between 10 and 20 $\mu g/m^3$, were measured over the southwestern United States

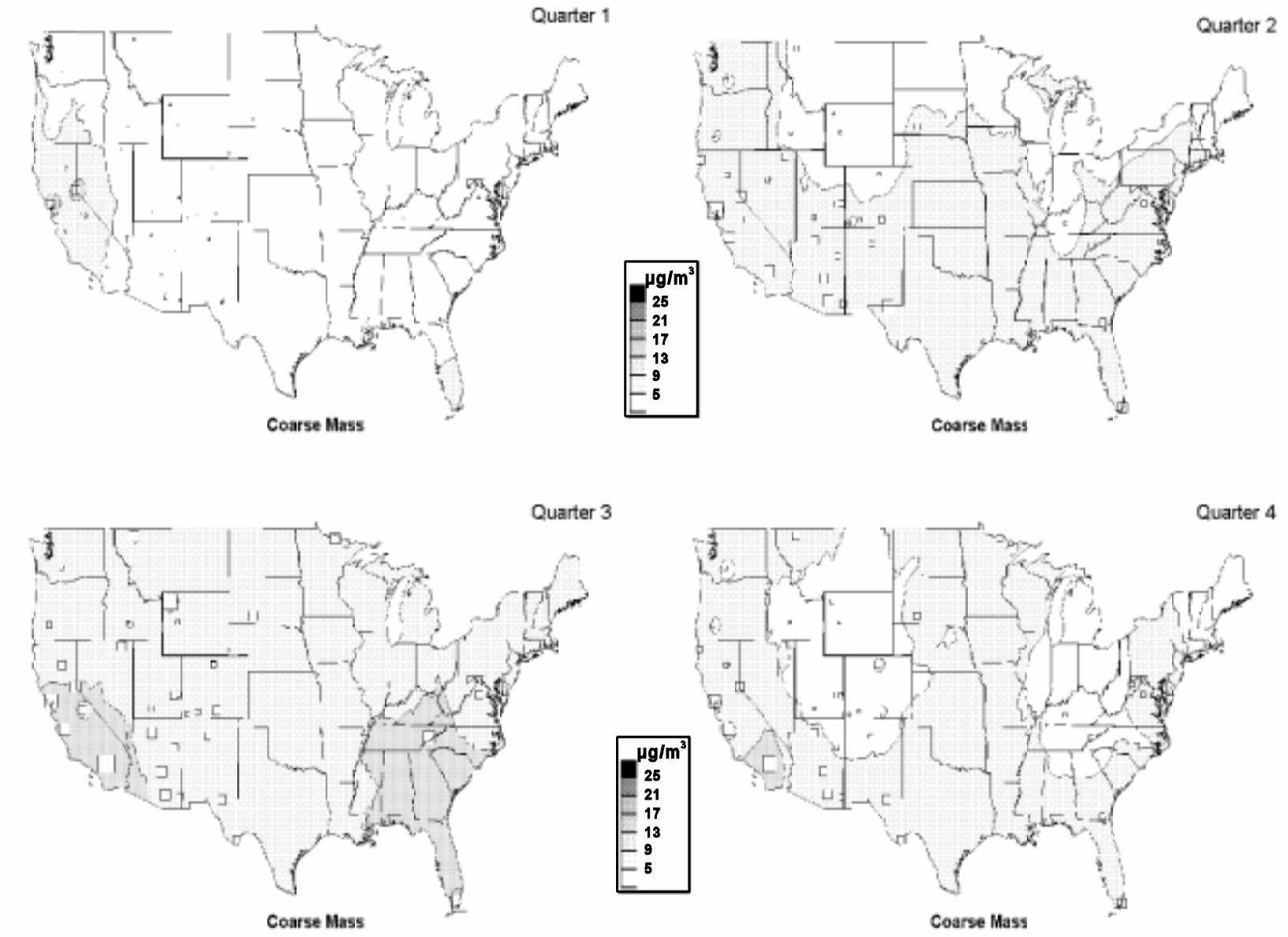

Figure 6-9. Coarse mass concentration derived from nonurban IMPROVE/NESCAUM networks.

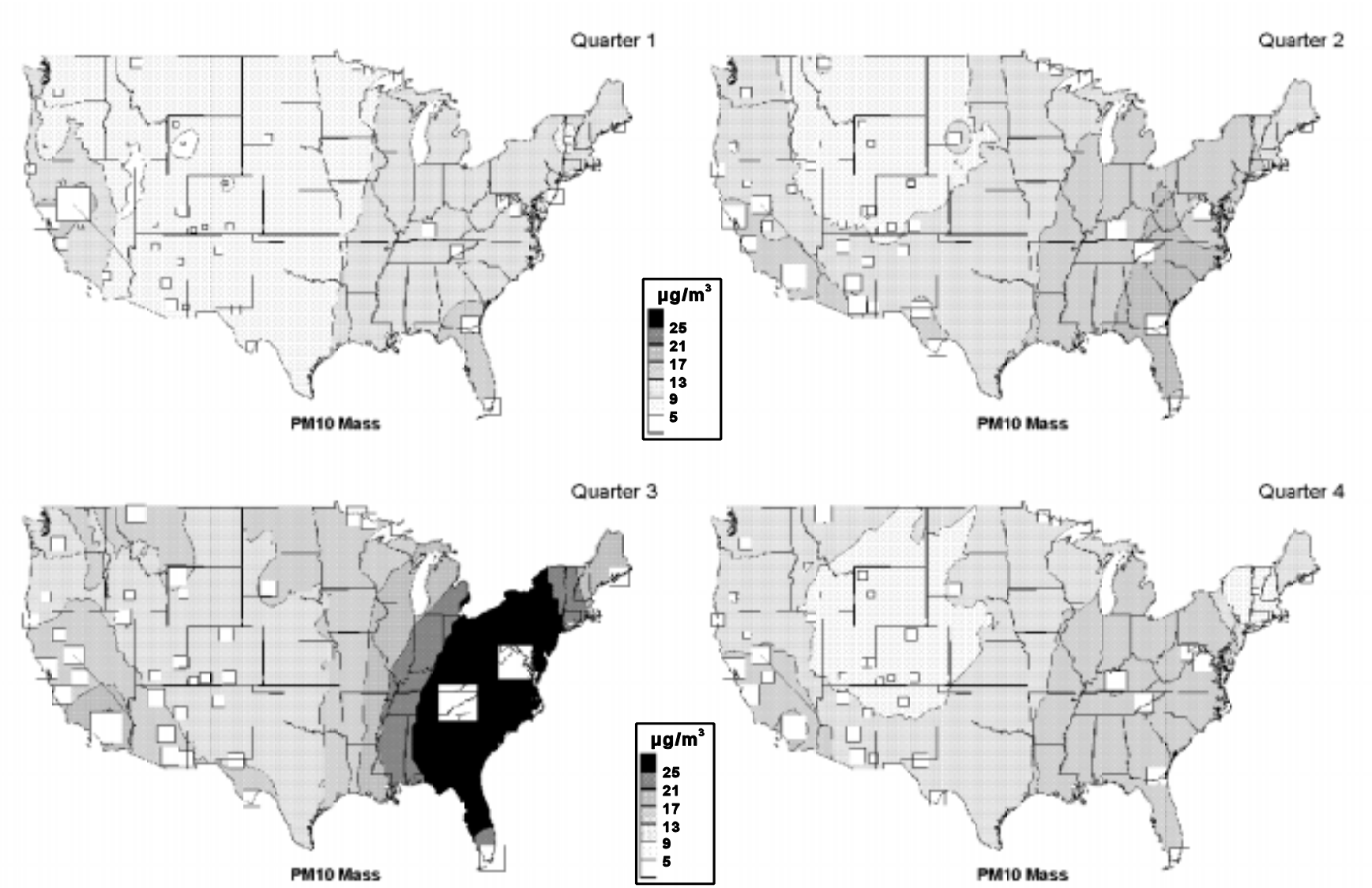

Figure 6-10. PM_{10} mass concentration derived from nonurban IMPROVE/NESCAUM networks.

as well as over the Pacific states from California to the Northwest than over the central mountainous states.

6.3.1.4 $PM_{2.5}/PM_{10}$ Ratio at Nonurban Sites

The PM_{10} aerosol mass is composed of fine mass ($PM_{2.5}$) and coarse mass, below 10μm (Figure 6-10). Both the sources and the effects of fine particles differ markedly from those of coarse particles. For this reason it is beneficial to examine the relative contribution of $PM_{2.5}$ and PM_{10} concentrations. Figure 6-11 shows the seasonal fine mass as a fraction of PM_{10}.

Nationally, the fine fraction at nonurban sites ranges between 0.4 and 0.8. The highest fine fraction is recorded east of the Mississippi River, where 60 to 70% of the PM_{10} mass is in particles <2.5 μm in size. This is also the region that shows the highest PM_{10} concentrations; thus, fine particles dominate the nonurban aerosol concentrations east of the Mississippi River. The fine fraction exceeds the coarse fraction at the nonurban northwestern sites. The fine fraction is the lowest in the southwestern United States (< 50%), particularly in the spring season (Quarter 2).

Spatial and seasonal variation of the fine fraction is a further indication for the existence of different aerosol regions over the conterminous U.S. This is further illuminated in Section 6.4 where the aerosol characteristics over different regions of the United States are discussed.

6.3.1.5 Nonurban Fine Particle Chemistry

The elemental composition of nonurban fine particles over the conterminous United States is now reasonably well understood. The IMPROVE/NESCAUM network provides over five years of aerosol mass and chemical composition data. The data from these networks allows the chemical apportionment of the fine particle mass into aerosol types such as sulfates, organic carbon, elemental carbon, and fine soil (Schichtel and Husar, 1991; Sisler et al., 1993, Sisler and Malm, 1994). The quantification of these aerosol types is relevant to both the determination of aerosol effects and source apportionment of particle mass. It should be emphasized that urban areas, mountain valleys, and remote monitoring sites are likely to have different relative concentrations of the aerosol types. Also, the quantification of semivolatile organic compounds, nitrates, and other unstable species is subject to major uncertainties.

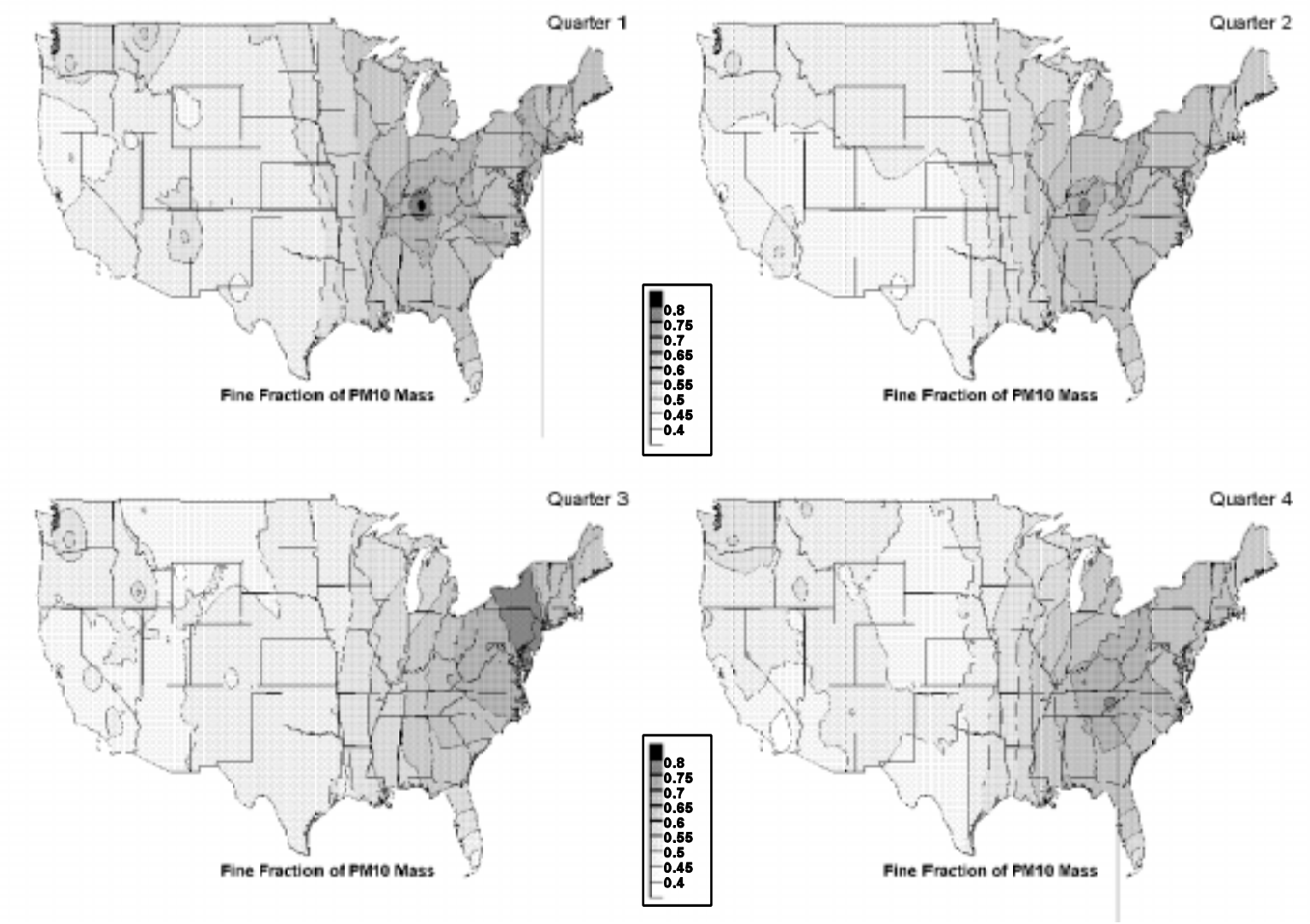

Figure 6-11. Fine fraction of PM_{10} derived from nonurban IMPROVE/NESCAUM networks.